



# Cellular and Molecular Cross-talk in the Heart after Acute Myocardial Infarction

Heart Attack Research Team – HeART

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Germany

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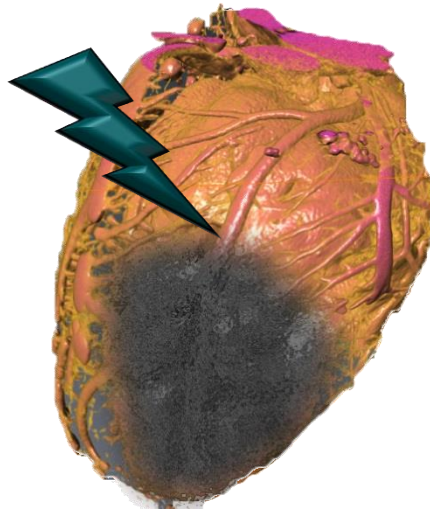
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Zentrum für  
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# Myocardial infarction



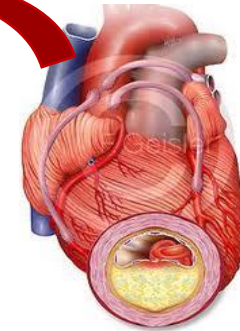
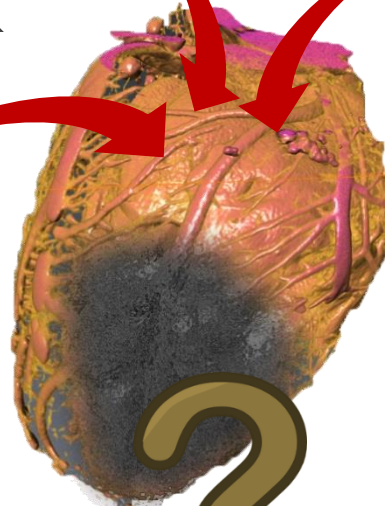
Death of the myocardial tissue as a result of blockage of a coronary artery, usually because of atherosclerotic changes of the vessel wall, or thrombosis.



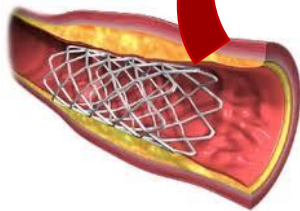
# Myocardial infarction



Drugs Therapy

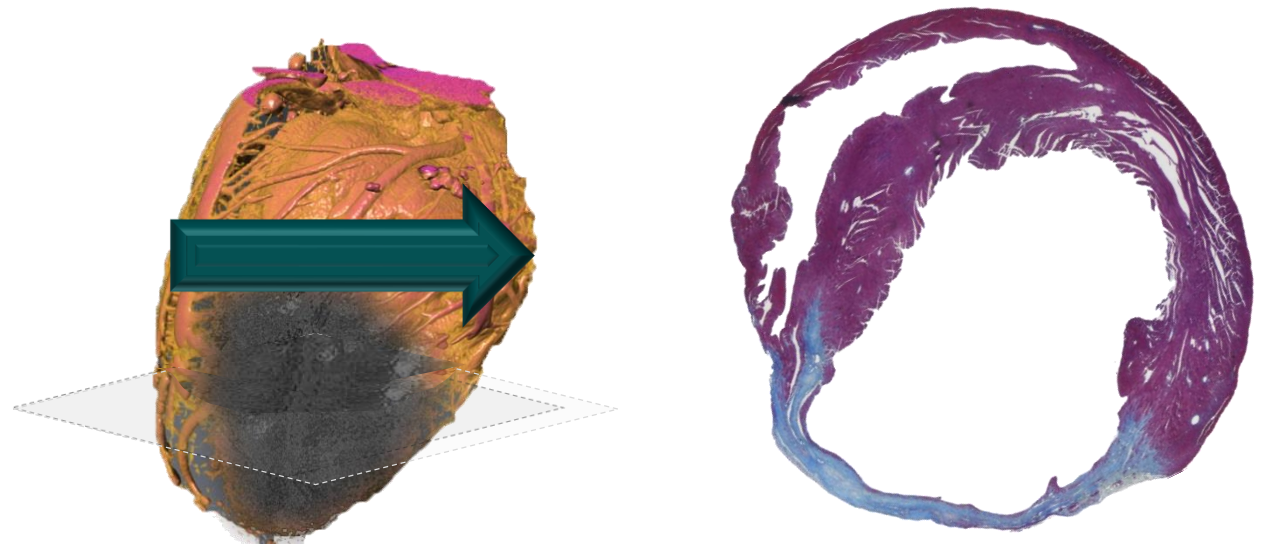


Bypass Operation



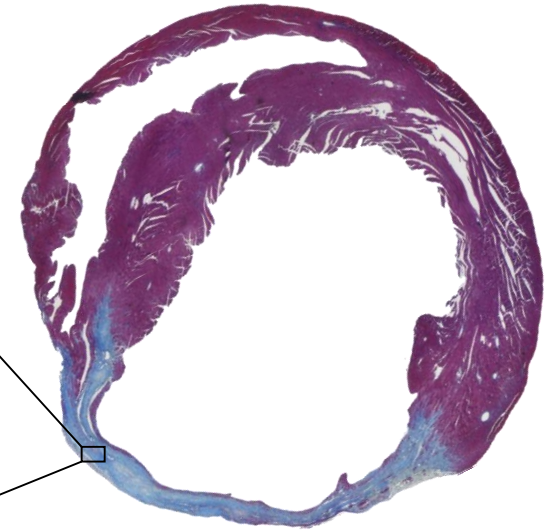
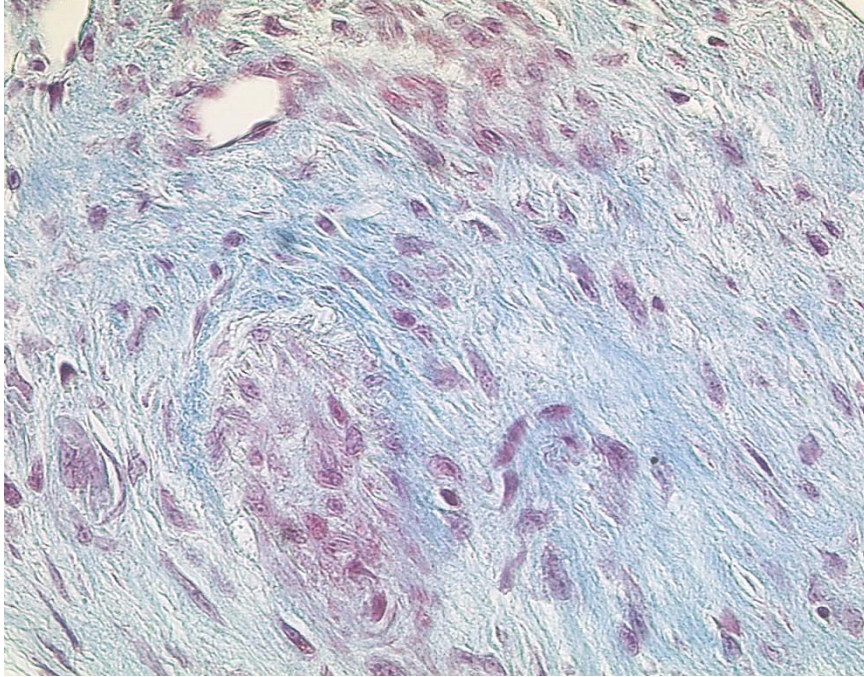
Stent Implantation

# Myocardial infarction





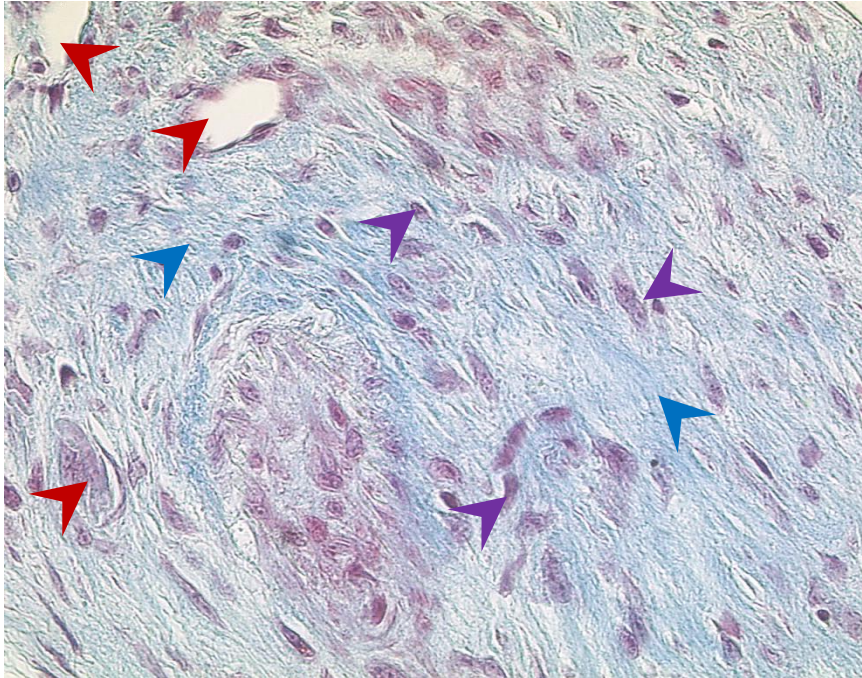
# Myocardial infarction



# Myocardial infarction

Vessels

Cells

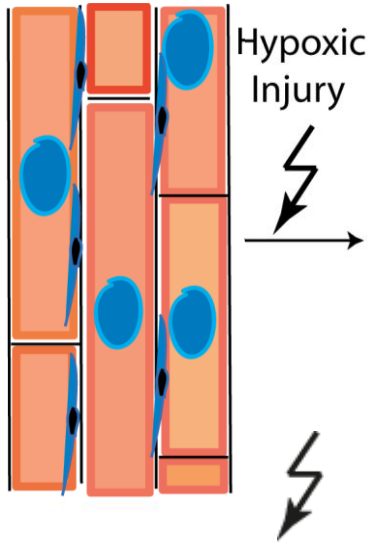


**Vital Tissue**

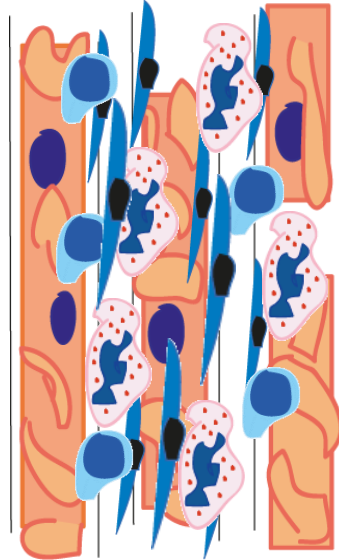
**Extracellular Matrix**

# Myocardial infarction

Normal Myocardium



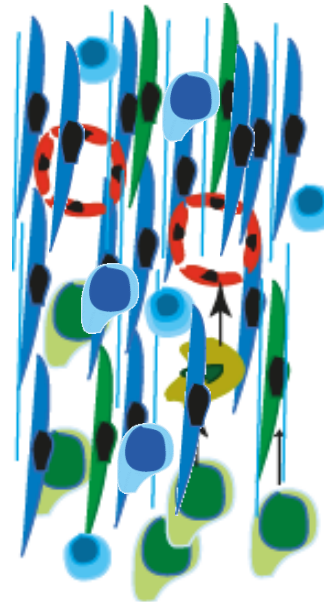
Inflammatory Phase



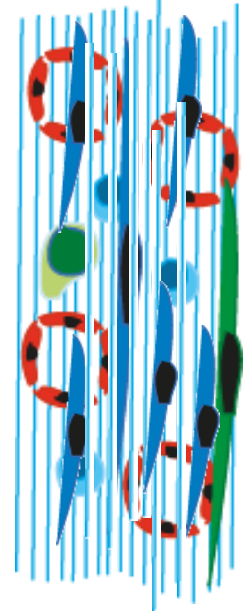
TGF- $\beta$ 1



Proliferative Phase



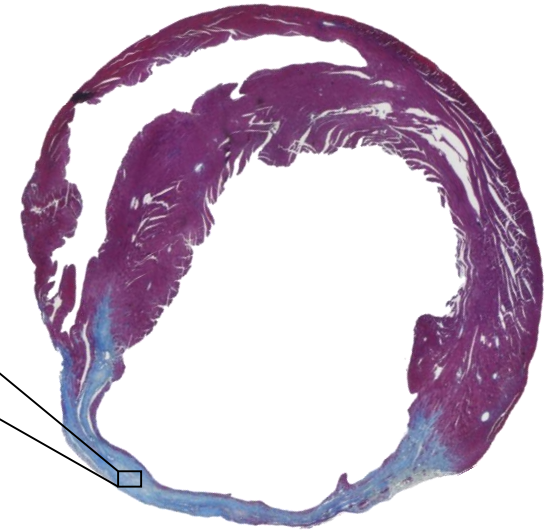
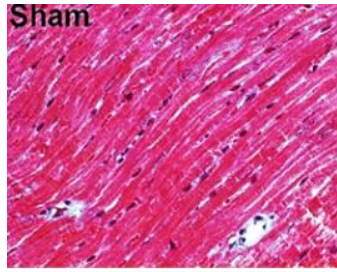
Healing Phase



Time course (weeks)

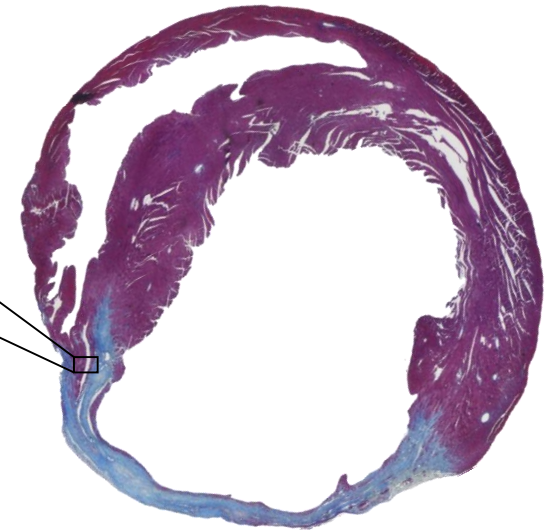
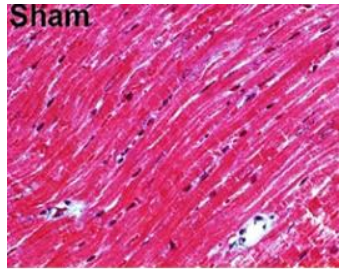


# Scar area

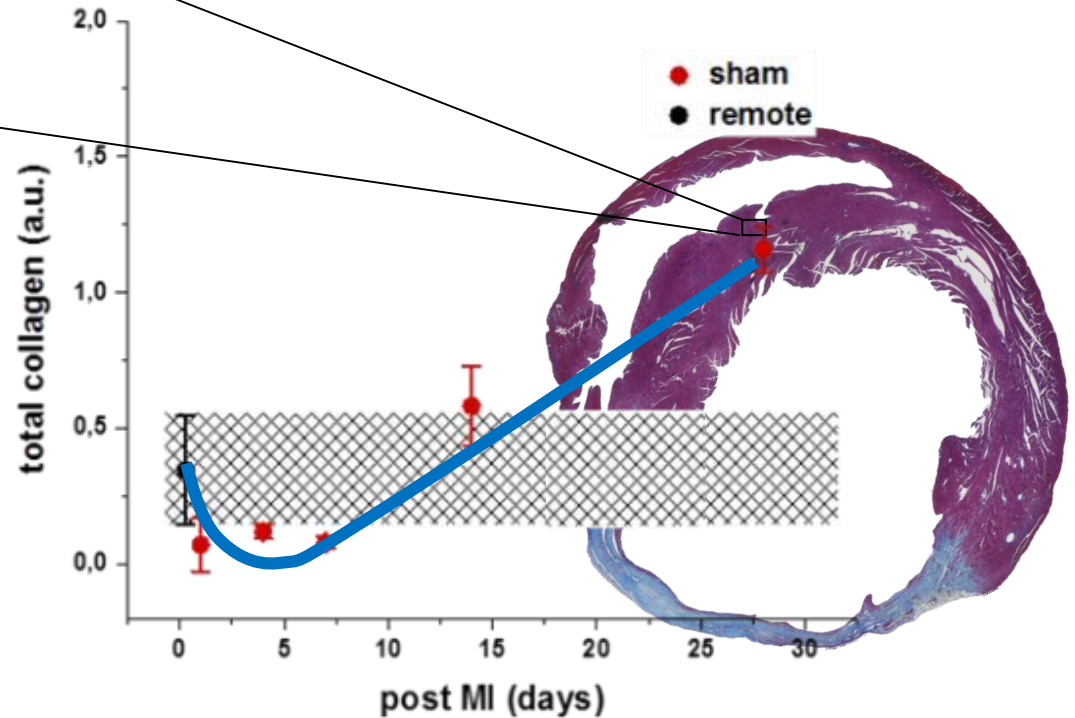
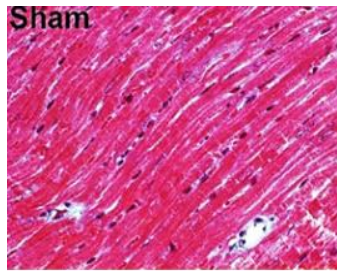




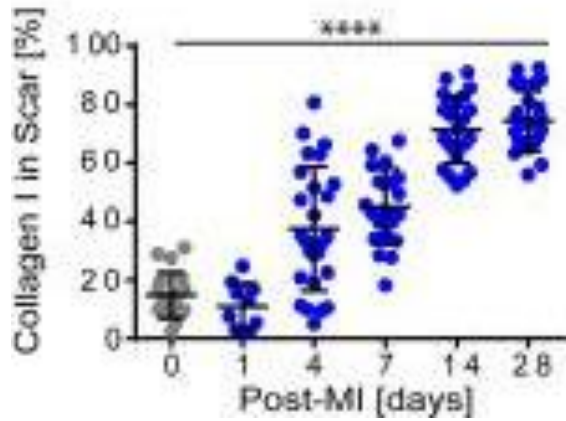
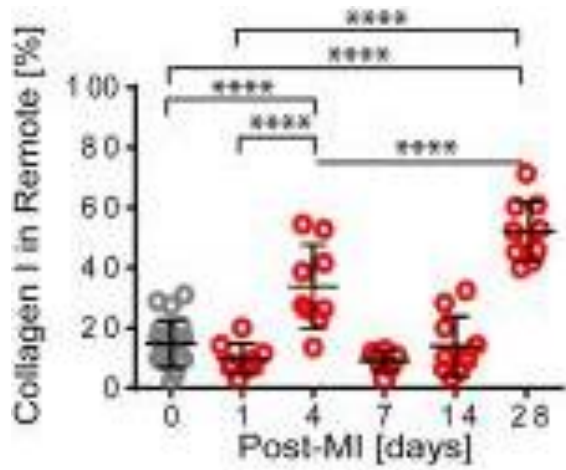
# Border area

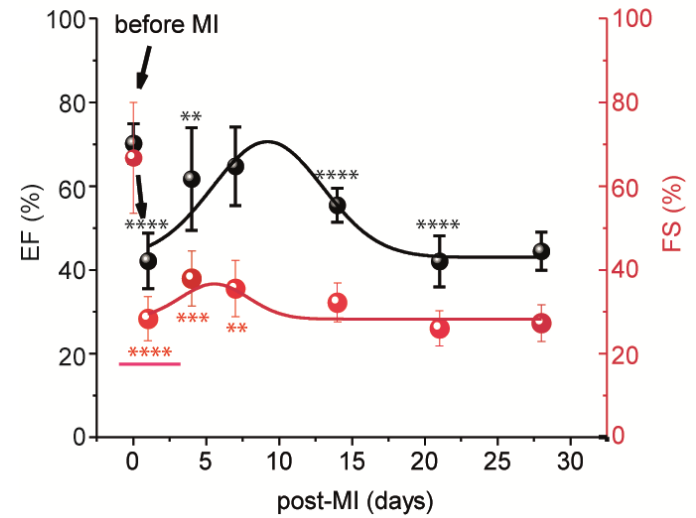
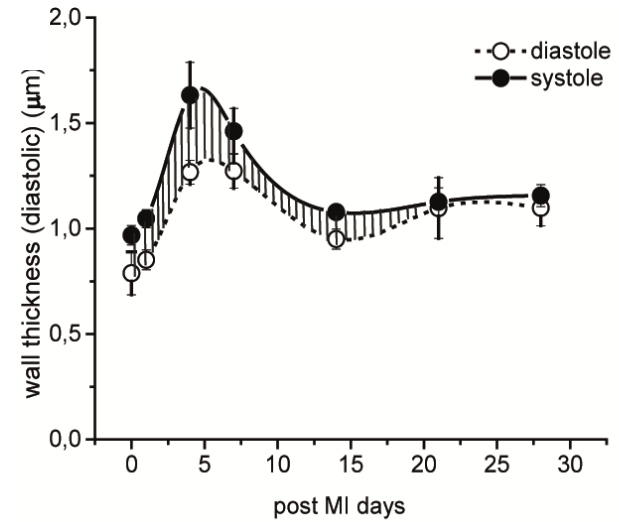
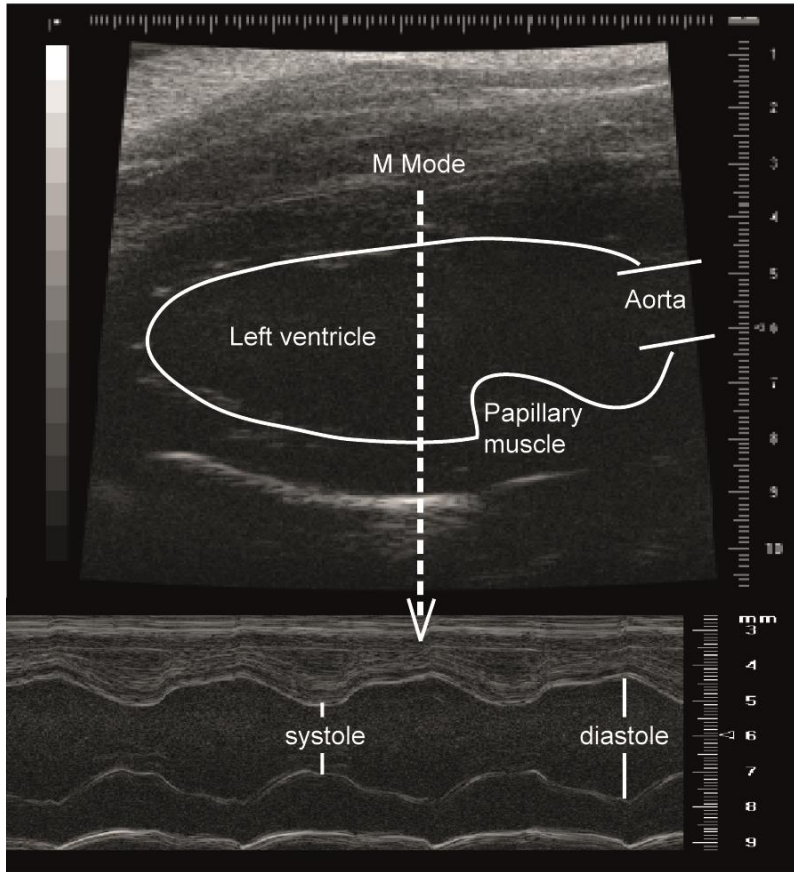


# Remote area



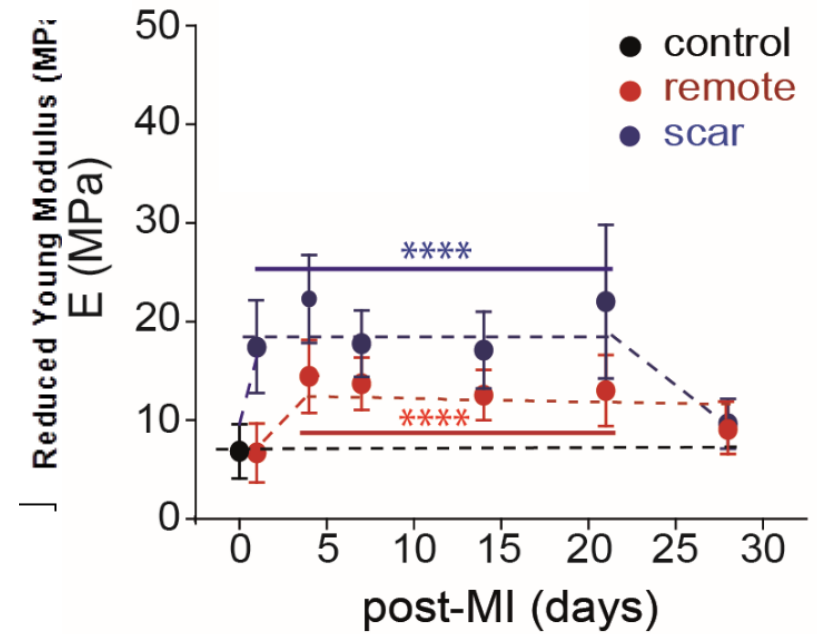
Increased interstitial tissue in remote area after myocardial infarction

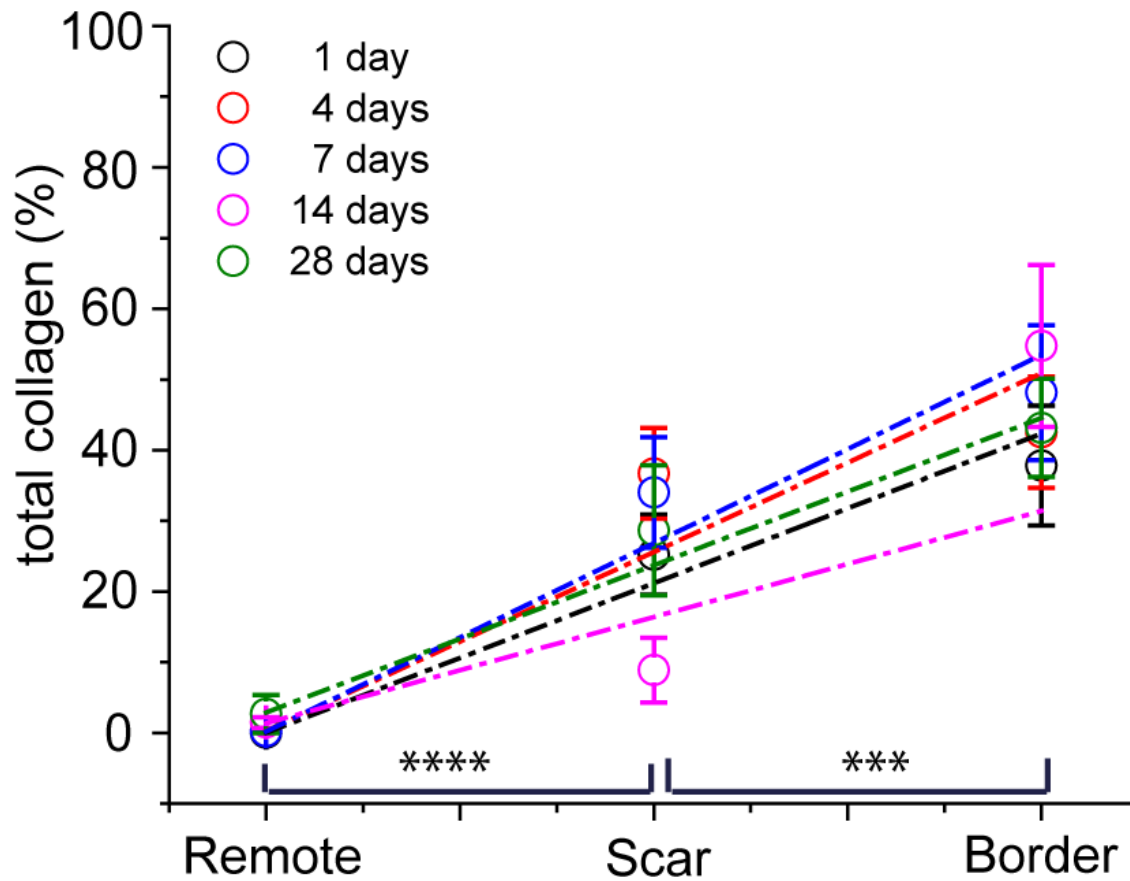


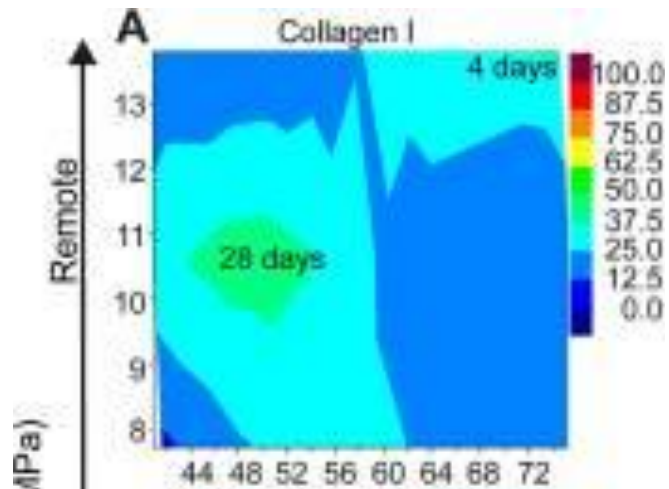




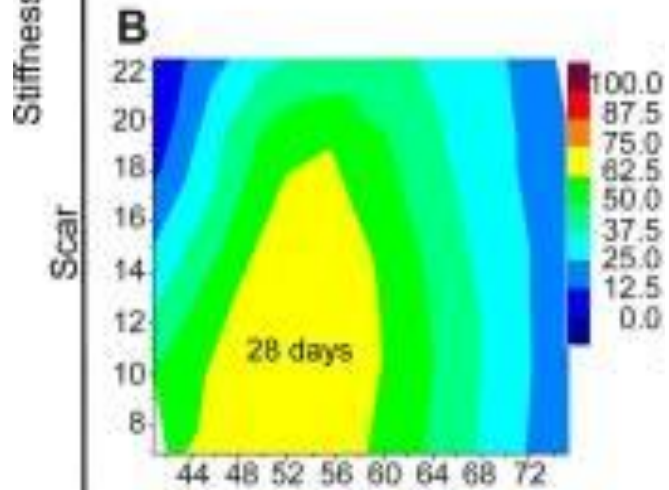
# Myocardial infarction





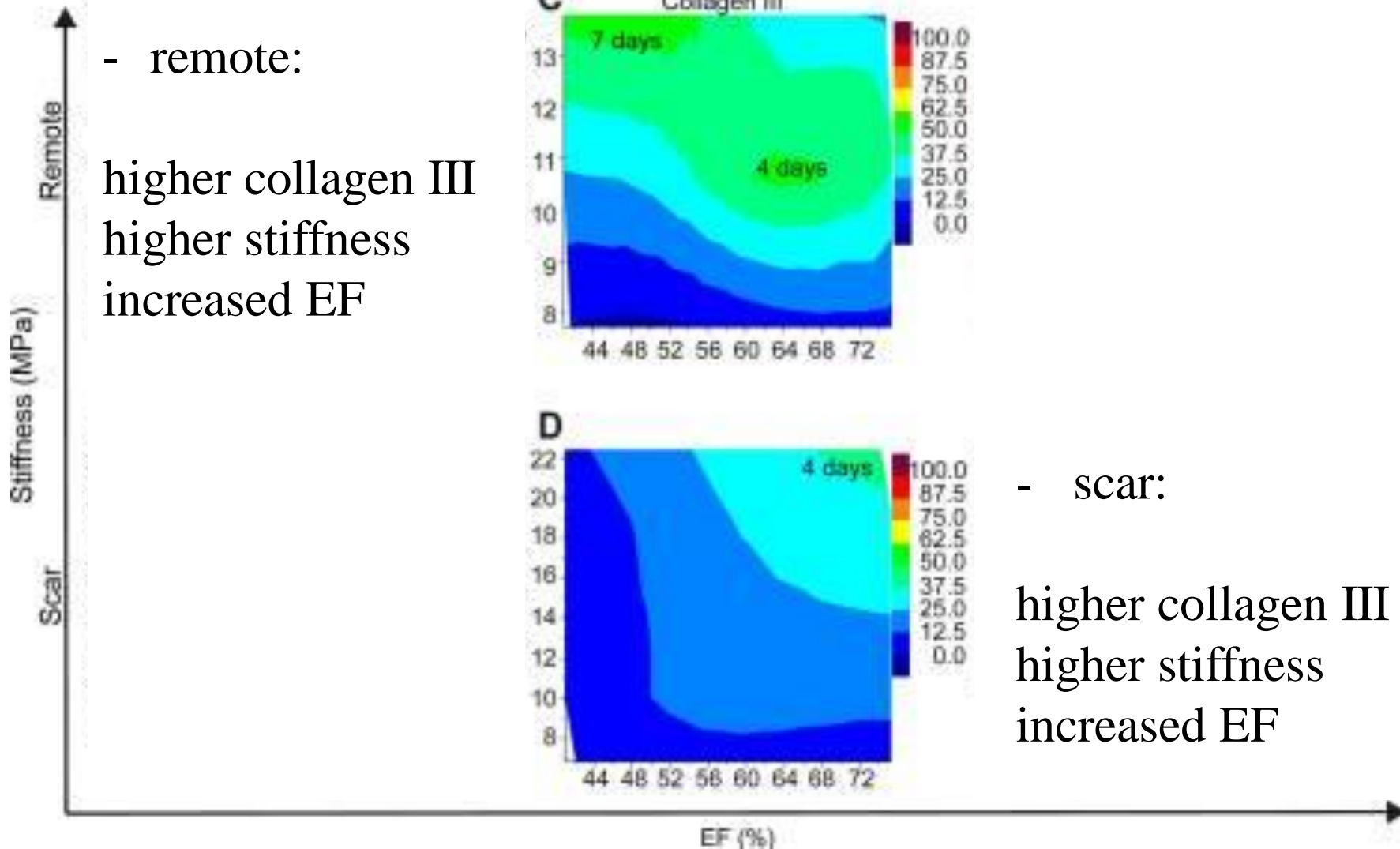


- remote: higher type I collagen  
low stiffness  
compensatory EF

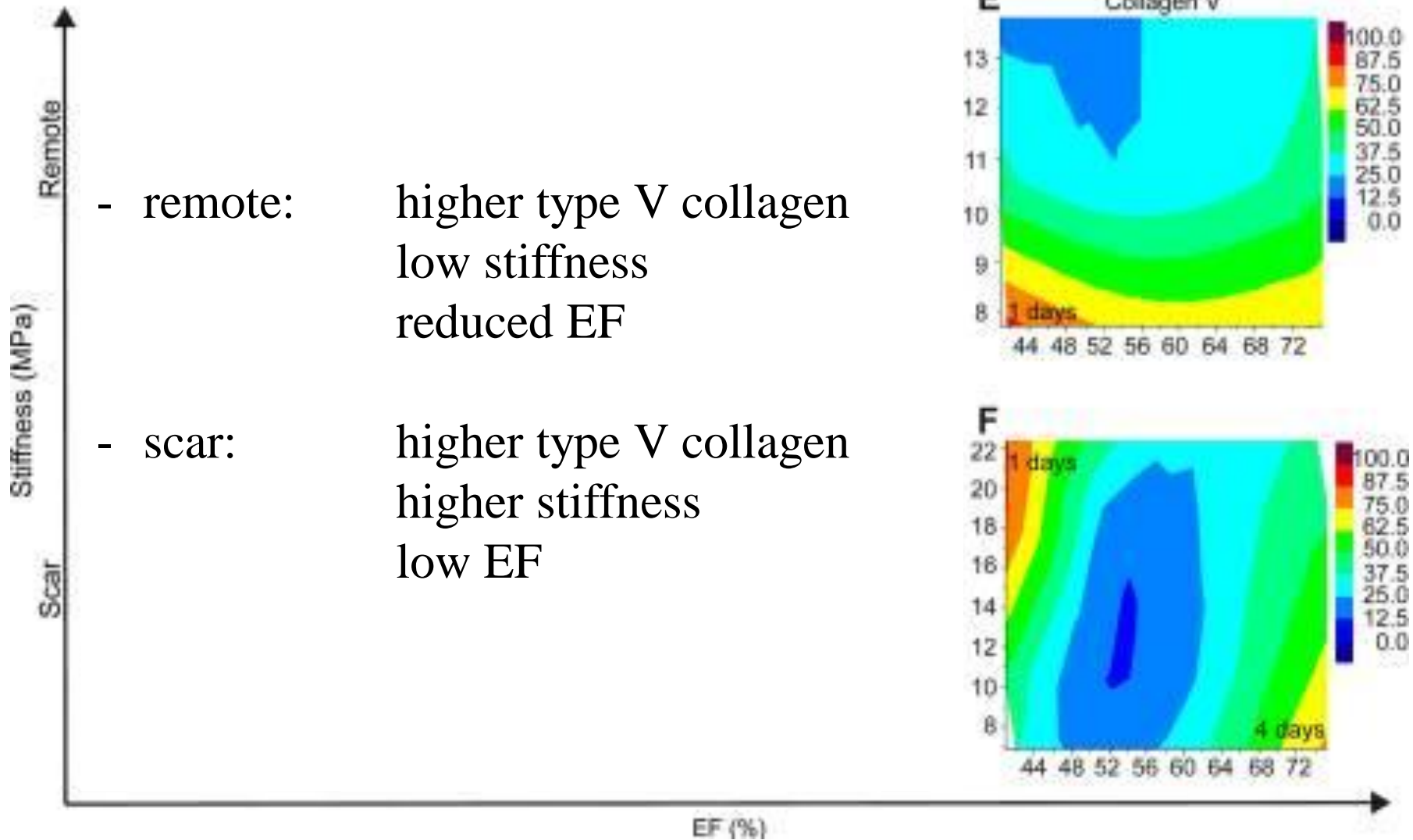


- scar: higher type I collagen  
low stiffness  
low EF

EF (%)

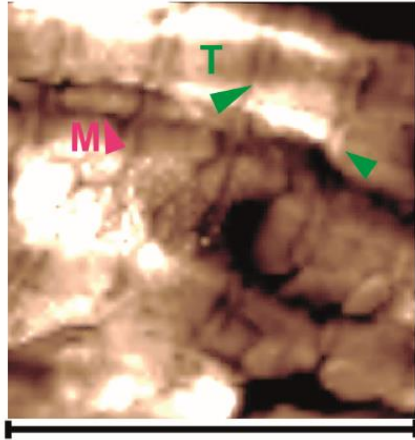




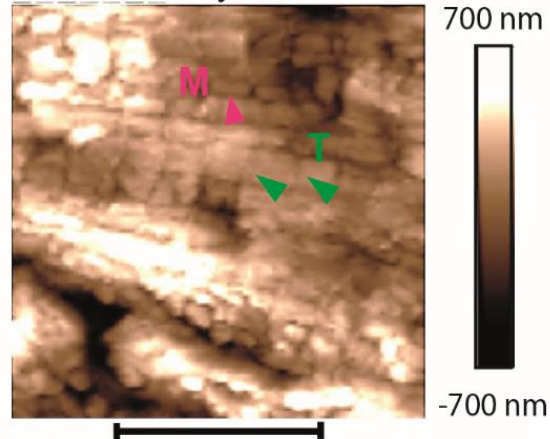


# Cardiomyocytes cell topology

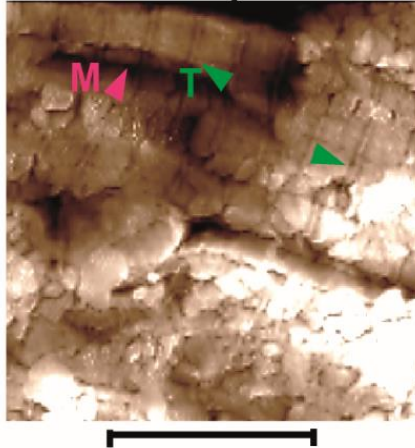
Control



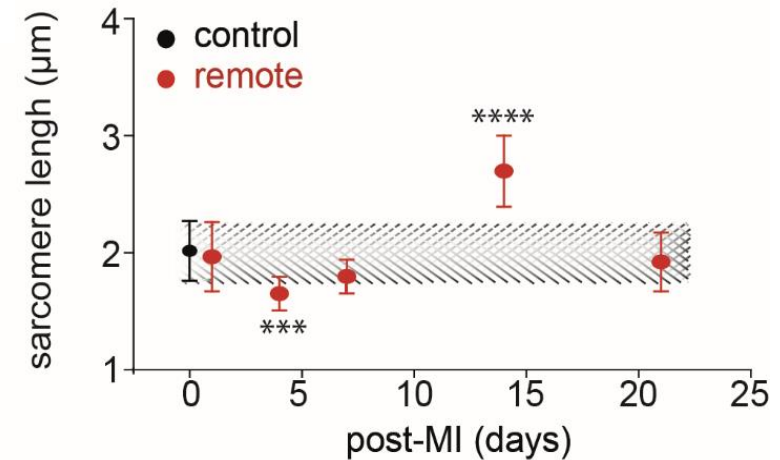
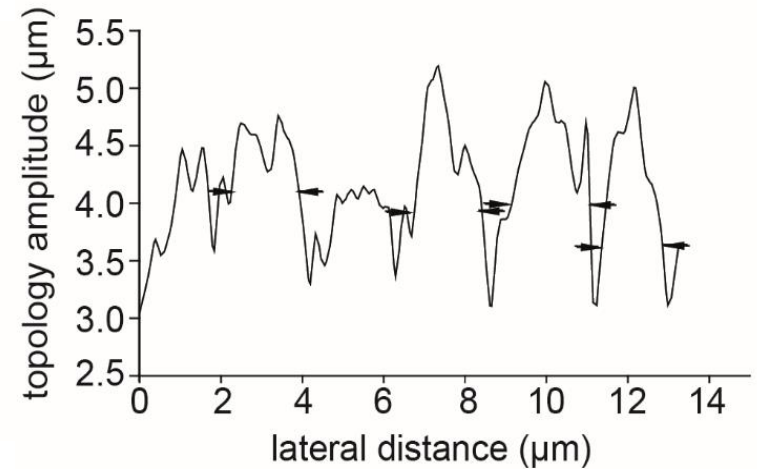
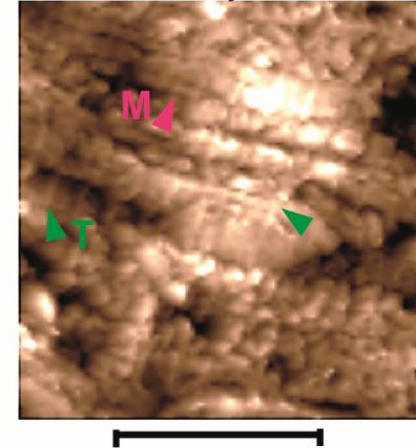
Remote 7 days



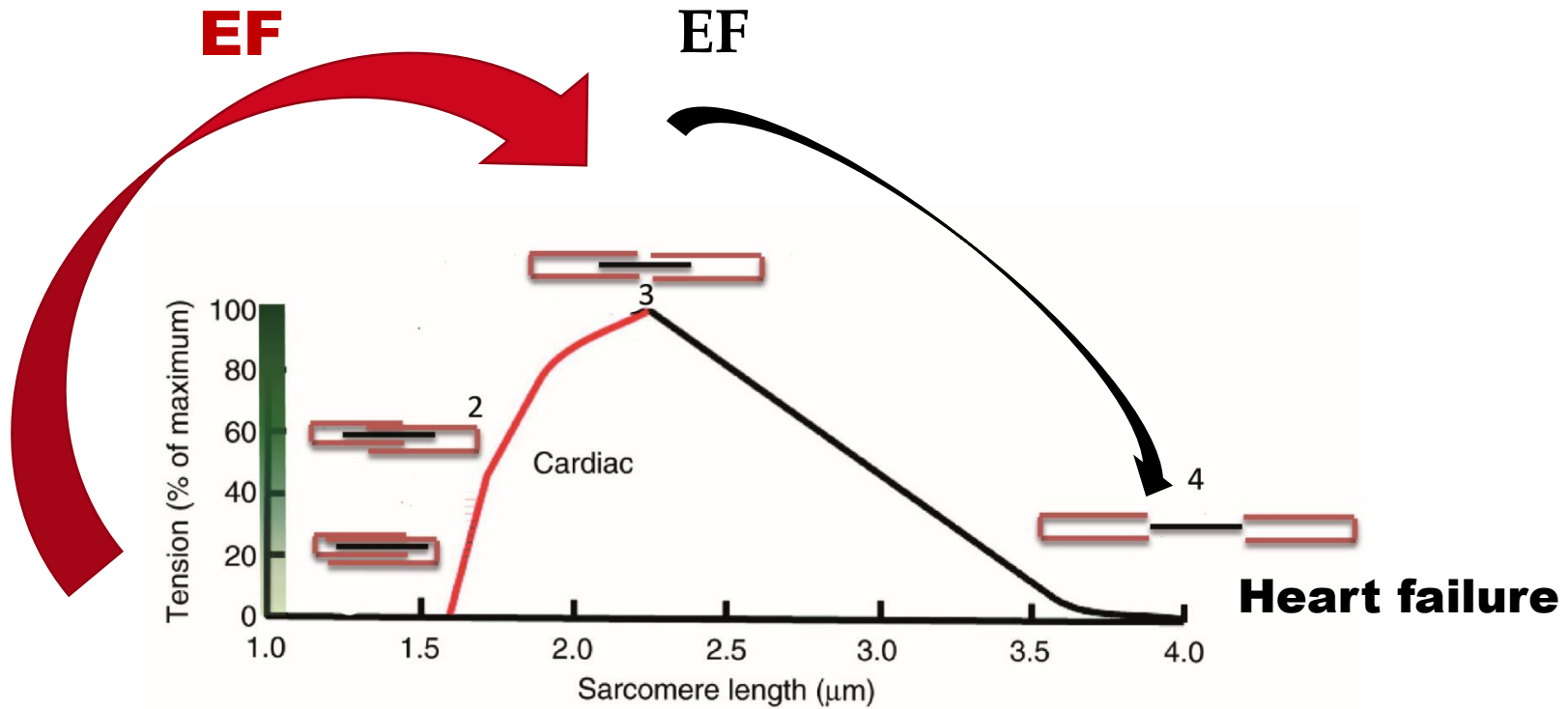
Remote 14 days



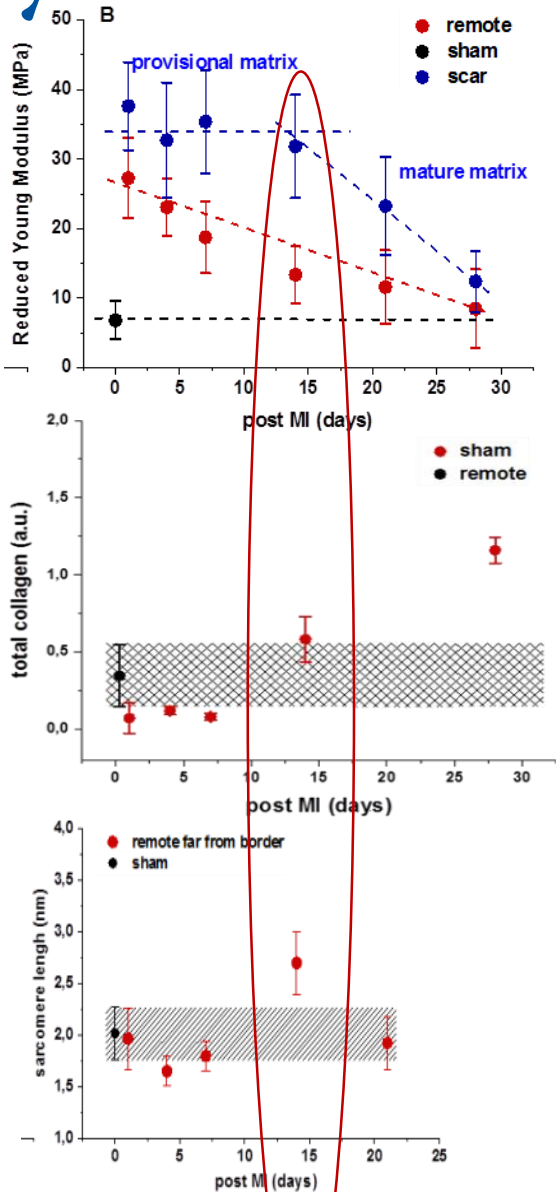
Remote 28 days



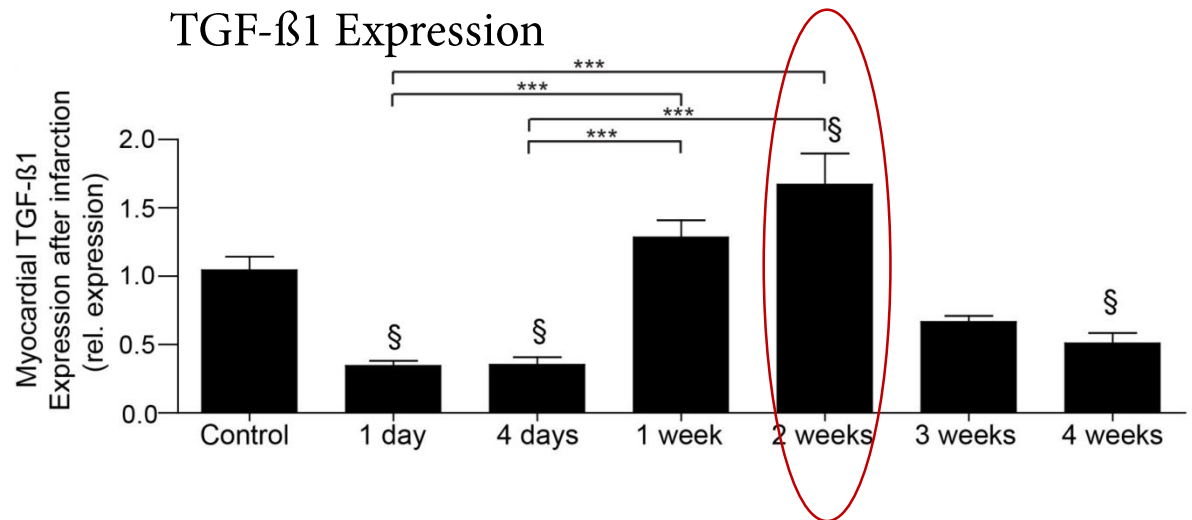
# Frank-Starling Law



# Myocardial infarction

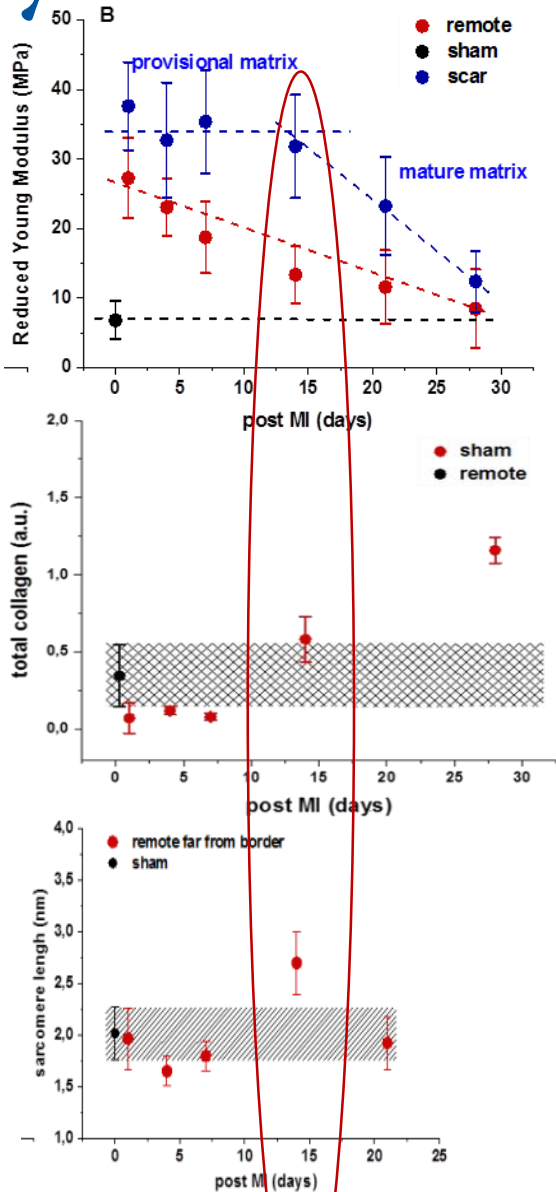


Critical point : 2 weeks after myocardial infarction  
TGF- $\beta$ 1 Expression

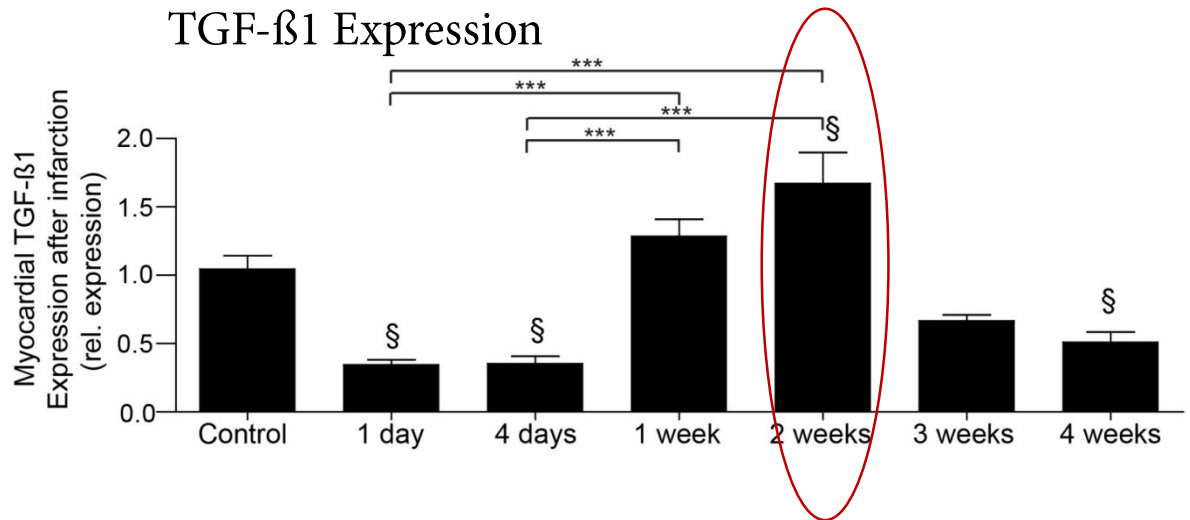




# Myocardial infarction



Critical point : 2 weeks after myocardial infarction  
TGF- $\beta$ 1 Expression



# Myocardial infarction

**Critical point :** 2 weeks after myocardial infarction  
TGF- $\beta$ 1 Expression

- Proliferation of fibroblasts, differentiation and starting the ECM production
- Each subtype of collagen behaves differently influencing stiffness and function
- Clearance of the dead tissue its fast replacement
- Stop of the inflammatory reaction
- Macrophage polarization
- Angiogenesis
- Preserved tissue integrity
- Preserved electrical and mechanical activity

**Preserved function**



# Conclusions

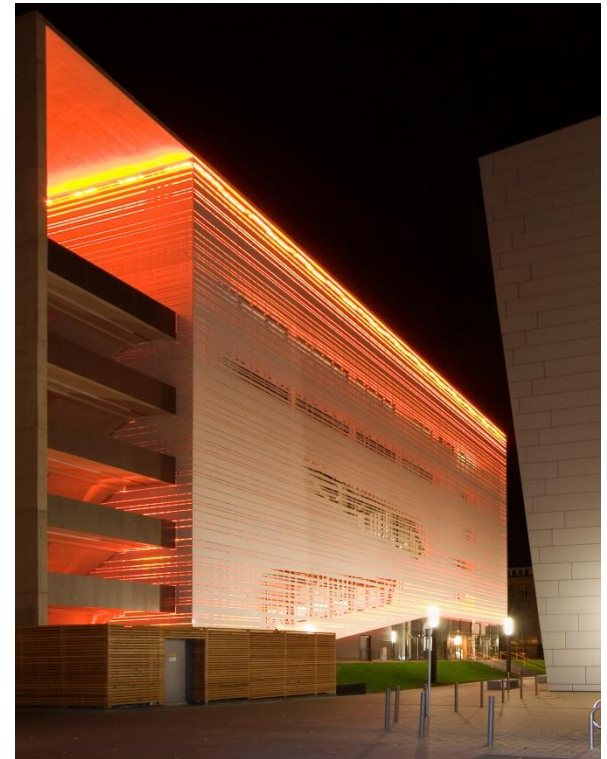
- Remodelling of remote, scar, and border might be revealed by correlative morpho-biomechanics cross-talk of architectural organization of collagen, the extent of sarcomere contraction
- Morpho-biomechanics cross-talk at different structural levels dictate the course of healing after MI towards survival or failure.
- This concept defines new frontiers and perspectives to handle the function and the structure of heart as a unitary concept when design therapeutic strategies for cardiovascular diseases

# Acknowledgment

## Heart Attack Research Team – HeART



**Dr. Adelina Curaj**  
**Dr. Zhuojun Wu**  
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**Roya Soltan**  
**Leon Decker**





# Let's join to find the way!



# Thank you for your attention !

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